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APPLICATION OF HCMM THERMAL DATA TO SNOW  
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INVESTIGATION OF THE APPLICATION OF  
HCMM THERMAL DATA TO SNOW HYDROLOGY

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Type II Report for Period  
October through December 1978

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## 1. INTRODUCTION

### 1.1 Objectives of Investigation

The objectives of the investigation of the application of HCMM thermal data to snow hydrology (HCMM Investigation No. 036) are as follows:

- (1) Determine practical utility of HCMM thermal IR data to establish distribution of snow cover and determine accuracy of temperature measurements.
  - a. Determine accuracy of surface temperatures acquired through use of HCMM thermal IR measurements.
  - b. Determine relative resolution utility between VHRR and HCMM for thermal IR measurements.
  - c. Specifically delineate and quantify the problems involved with measuring snow temperature from space and relate them to present and planned earth observing satellite systems. This objective will take into consideration and utilize the capability of HCMM for day and night thermal measurements over appropriate sites and the satellite's eight-day repeat cycle.
- (2) Determine if and how HCMM measurements can be factored in with Landsat data into an overall snow hydrology program related directly to snowmelt runoff prediction.
- (3) Develop an approach to automated data processing of combined visible and thermal infrared satellite acquired data to provide information of interest and use to the snow hydrologist.

### 1.2 Anticipated Results

The primary anticipated result of the proposed investigation is the development of improved techniques for the mapping and analysis of snow-cover using spacecraft-acquired data. The results will provide an evaluation of the usefulness of high resolution thermal infrared data for snow mapping and for input to snowmelt prediction programs; and will provide a better understanding of the relationships between the measured temperature values and such factors as type of snow, snow depth, type of

terrain, and vegetation. The mapping and analysis techniques can then be applied to the automatic processing of data from future spacecraft systems, and will eventually enable snow survey, which is a vital part of water resources management, to be accomplished on a more cost-effective basis.

## 2. ACCOMPLISHMENTS DURING REPORTING PERIOD

During this reporting period we have been able to begin preliminary analysis of the HCMM digital data. Four CCT's have been received to date, containing the daytime visible and IR data for passes which occurred on 31 May and 6 June 1978 over the West Coast region. Our efforts have concentrated on portions of the daytime IR pass on 31 May covering the Sierra Nevada in California. We have selected for analysis a small area, encompassing non-snow covered and snow covered surfaces, water bodies, and clouds, which corresponds to the U-2 underflight data for 31 May 1978.

Preliminary analysis indicates a good correlation between surface temperatures indicated in the U-2 data and the HCMM data. Recorded HCMM temperatures are in agreement with expected temperatures for the types of surface features within our test site. Our efforts during this reporting period have been limited by the late arrival of digital data and the lack of digital nighttime IR data.

## 3. PROBLEMS

At the HCMM Experimenters Team (HET) meeting held in December, the impact on the investigations of the delay in processing HCMM data was discussed by the HET members. In particular, it was pointed out that the delays in data delivery would make it difficult for the investigations to be completed within the contractual time limits. At the request of the HCMM Project Scientist, we have submitted a letter providing information about the requirements for an extension in time and additional funding for our investigation.

As stated in the letter, since HCMM was not launched until the end of April, fewer useful data than had been anticipated were collected during the 1978 snowmelt season. For example, it was too late to obtain

any data over our Arizona test site. We expect, therefore, that a considerable amount of data for use in the study will be collected during the current (1978-79) snow season.

We had anticipated that our preliminary analysis would have been completed by this time, using the data collected last spring. However, because of the delay in the HCMM data processing, we have, of course, not been able to complete the analysis of that data. Furthermore, because of the backlog in data processing, it will likely take longer for us to acquire any data collected during the 1978-79 season. According to the existing schedule of our contract, the draft final report is due by 23 June 1979. We believe that an extension in time until October 1979 is needed in order to complete a thorough evaluation of the HCMM data.

#### 4. PLANS FOR THE NEXT REPORTING PERIOD

Our objective for the next reporting period is a continuing analysis of HCMM digital data. We assume that standard data production will begin in early 1979, so that additional CCT's will be received.

Having only worked with the daytime IR tape so far, we hope to analyze both daytime and nighttime IR data to determine the diurnal variations in snowpack temperature and investigate the relationship between the observed variations and snowmelt conditions.

#### 5. TRAVEL

During the past reporting period, the Principal Investigator attended the fifth HET meeting, held at Goddard Space Flight Center on 12-13 December.

#### 6. PUBLICATIONS

No publications have resulted from this investigation.

## 7. SIGNIFICANT RESULTS

No significant results have been obtained through the fifth reporting period of the investigation.

## 8. FUNDS EXPENDED

Approximately 50 per cent of the available funds have been expended to date. As stated in the letter submitted on 3 January to the HCMM Project Scientist, we believe that an extension in time until October 1979 is needed in order to complete a thorough evaluation of the HCMM data. Also, because of the delays in data processing, we have spent a greater effort working with preliminary data that turned out to be not useful (such as U-2 data that were collected when the system was having problems). Therefore, additional funding will also be needed to carry our investigation until October 1979.